

and has become so necessary that it is difficult to conceive how we worked before its invention. To him we are also indebted for the apparatus for accelerating filtration, the "Bunsen-pump," together with all its appliances, now employed in every laboratory.

Of all the contributions to the advancement of our science, that by which the name of Bunsen has, however, become best known, and by virtue of which future generations will place him on the highest pinnacle of experimental fame, is the foundation, with his no less celebrated colleague Kirchhoff, of the science of Spectrum Analysis, and the discovery by its means of the two new alkali metals, caesium and rubidium. It is true, of course, that many facts were ascertained and many observations made relating to the power possessed by matter in the state of incandescent gas emitting rays of a peculiar and characteristic kind. Few great discoveries are made at one step. But the glory of having established a new branch of science, of having placed "Analysis by Spectrum Observations" on a sound and firm experimental basis, belongs to the Heidelberg philosophers, and to them alone.

The history of the establishment of spectrum analysis, as that of its enormous recent developments, is too well known to the readers of NATURE to require repetition. All that is necessary here is to recall the masterly way in which Bunsen worked out the properties and showed the relationships of the new metals and their compounds. He first saw the caesium lines in a few milligrams of the alkaline residue obtained in an analysis of the Dürkheim mineral waters, and the discovery of a second new metal (rubidium) soon followed that of the first. So certain was he of the truth of his spectroscopic test that he at once set to work to evaporate forty tons (44,000 kilos) of the water, and with 16.5 grammes of the mixed chlorides of the two new metals which he thus obtained, he separated the one metal from the other (no easy task) and worked out completely their chemical relationship and analogies, so much so that the labours of subsequent experimenters have done little more than confirm and extend his observations; such a result is truly a marvel of manipulative skill!

Another less widely known, but no less interesting and important research, is that on the spark-spectra of the metals contained in cerite and other rare minerals. In this he shows his power both as physicist and chemist. He first describes a new chromic-acid battery suited to the performance of the special experiments which he afterwards details. He determines with great care all the physical constants of this battery, and then proceeds to investigate the spectra of the earths which give no colour to the non-luminous flame. The spark-spectra of these earths he carefully maps, so completely, indeed, that the separation and identification of these metals now for the first time became possible.

The many hundreds of pupils who during the last half-century have been benefited by personal contact with Bunsen will all agree that as a teacher he is without an equal. Those who enjoy his private friendship regard him with still warmer feelings of affectionate reverence. All feel that to have known Bunsen is to have known one of the truest and noblest-hearted of men.

H. E. ROSCOE

JAPAN

Japan, nach Reisen und Studien in Auftrage der k. Preuss. Regierung dargestellt. Von J. J. Rein, Professor der Geographie in Marburg. Erster Band. Natur und Volk des Mikadoreiches. (Leipzig: Engelmann, 1881.)

Notes and Sketches from the Wild Coasts of Nipon. By Capt. H. C. St. John, R.N. (Edinburgh: Douglas, 1880.)

THE present year has already brought two new contributions to the rapidly increasing stock of Japanese literature in "Japan, nach Reisen und Studien," by Prof. Rein of Marburg, and "The Wild Coasts of Nipon," by Capt. St. John. The two works thus thrown into association by subject and time of publication have however nothing else in common.

Had Capt. St. John's book been written a few generations ago, or had it related to a country previously unexplored, it would have possessed a greater claim upon popular interest; but Japan has in late years been so far the object of careful study by residents, and of descriptions by tourists, that the *raison d'être* of "The Wild Coasts of Nipon" is not easy to perceive.

In the preface the reader is assured that everything stated in the text, with a few exceptions, came under the observation of the author, and there is no doubt that he has scrupulously confined himself to his own personal experience, without seeking to correct or augment it by reference to other sources. The advantage of such a limitation of matter must however depend altogether upon the extent of the experience and the special qualifications of the observer, and we are of opinion that had the author taken the trouble to ascertain what his predecessors have already made known, he would have largely altered his notes.

The author as a sportsman and naturalist displays himself in a more favourable light than as a logician and observer. His sporting memoranda are amusing, and give a character to the volume, while as an amateur naturalist he shows more than average knowledge, and contributes some interesting facts on the subject of the animal kingdom. In the flora he is on less secure ground, and on one occasion, at page 137, confuses, in name at least, two such well known trees as the Hinoki (*Retinospora obtusa*) and the *Cryptomeria japonica*.

In his remarks upon the people he bears good witness to the simplicity and kindness of the peasantry, of whom he must have seen a good deal. Unfortunately, for a traveller unlearned in the language, and chiefly dependent for his entertainment upon ordinary tea-houses, he has rather rashly ventured into generalisations requiring information that very few foreigners possess. At page 182 the Japanese men, as a race, are said to be "well made, muscular, active, and strong, and averaging about five feet five inches¹ in height," a description applying fairly well to the northern fishermen, but certainly flattering to the nation in general. Again, in several places the author follows a common fashion in deploring the evils brought upon the people by European "civilisation," but makes no allusion to the greater evils it is now

¹ Dr. Rein's estimate of the average height of the men is 150 centimetres. This is nearly as much below the mark as Capt. St. John's calculation is above it.

expelling, and ignores the fact that any deterioration which has followed the recent change of circumstances is not the work of "civilisation," but of the vile or foolish camp-followers that may cling to the skirts of even the noblest army.

Upon the religion of the country he says little more than is to be found in a footnote at page 127; but students may be interested to learn from this that "Shinto is never represented by any figure, but worshipped as the Unseen Spirit which pervades everything. Buddha, as is well known, is always represented by a male figure; Shinto, the unrepresented, is supposed to be a female."

Criticism of the volume is to some extent disarmed by the modesty of its preface, and it no doubt contains much that will amuse the general reader.

In Dr. Rein's "Japan" we have the work not only of a *savant* thoroughly versed in his subject, but of a practised literary architect. The present volume deals with the geographical conformation, climate, flora, and fauna of the Japanese group, and the history, ethnography, and religion of the people, concluding with a useful chapter on topography. A future volume is to comprise an account of the industries and commerce, and will be welcomed by all who read the part now before us.

The geographical summary is far more complete and accurate than any to which the public has yet had access, and at every page shows the hand of an expert who has brought original knowledge and personal observation to bear upon his task. The climatic peculiarities are for the first time (save by the author himself in 1876) systematically described, and all the more important meteorological details accumulated in the past eighteen years in different parts of the country are reproduced in tabular form.

In the study of the flora and fauna the accumulation of facts is already too large to allow the author to go far beyond the limits of enumeration. Since Dr. Rein's account has been written a new addition has been made to the fauna in a catalogue of the birds of Japan by Capt. Blakiston and Mr. Pryer, and the number of known species raised from about 250 to 325, of which about 180 occur also in China, and about 100 are represented in Great Britain.

It is to be regretted that space could not have been spared for a little supplementary information upon some of those members of the animal kingdom which possess a more popular interest. For example, a few details respecting the dangerous and unpleasantly common *Mamushi* (*Trigonocephalus Blomhoffii*) and the wrongly maligned little *Hibakari* (*Tropidonotus Martensii*) would have been useful. The poisonous properties of certain species of the *Fugu* or genus *Tetrodon* are pointed out, and the symptoms produced by their use as food described; but in the reference to the "*hungerige, blutgierige Mosquitos*," though feeling tribute is paid to the vexatious side of their character, the grave charges to which they are open are omitted, their probable agency, long recognised by native physicians, in the conveyance of malignant pustule, and the suspicion raised by Dr. Patrick Manson's investigations in Amoy, that the spread of Elephantiasis *Arabum* in the south of Japan is due to the same pest.

The second and less technical part of the book embraces subjects upon which the author is less able to speak

in verba magistri than on geographical science. The section, "Das Japanische Volk," opens with an historical abstract of about 200 pages, compiled from Klaproth, Kämpfer, Siebold, Satow, Aston, and other authorities. The purely mythical stories of the age of the gods are passed over rapidly, and the commencement of the history of the country is fixed at the reign of Jimmu Tenno (660 to 585 B.C.). Dr. Rein is generous enough to acknowledge without question the reputed founder of the imperial lore, of whose existence there is little more proof than of that of the *Uwabami* and *Kamaitachi*, which the Professor does not consider entitled to a place in the fauna. As is mentioned in a footnote, the earliest written records extant originated in the first part of the eighth century of our era, and admitting the possibility that these were compiled from lost manuscripts of older date, they still offer satisfactory internal evidence that the historical being of Japan is at least a thousand years younger than is indicated by the list of the ancient emperors from whom the reigning Mikado traces his descent. The fact will perhaps be sufficiently demonstrated by a citation of the ages attributed to certain of the primitive rulers. The inaugurative myth, Jimmu Tenno, is said to have lived 127 years; Koan, the sixth Mikado, 137 years; Nintoku, the seventeenth Mikado (D. 399 A.D.), 122 years; and it is not until the fifth century A.D. that the viability of the rulers appears to have become permanently limited to a reasonable degree. It is true that the birth and death of Jimmu are solemnised as national festivals, and that writers on such sober topics as the industrial arts do not hesitate to refer for their landmarks to periods long antedating the true historical period; but all allowance must be made for inherited credulity in ancient traditions, which here form part of a state religion and establish the very sanctity of the throne.

We are glad to see that Dr. Rein does not altogether reject the romantic episodes of Japanese history. Awaiting the advent of a native Walpole to bruise the simple faith of his countrymen with historic doubts, it is a grateful relief to the tedium of the long series of wars and court intrigues that form the burden of the rather monotonous recitative of the Oriental Clio, to dwell for a moment on such stories as those of the gentle wife of Yamato Dake, who cast herself into the sea to propitiate the angry gods that threatened the safety of her husband's ship; of Kesa, who sacrificed her life to preserve her wifely fidelity; and many others of the number that have lent inspiration to the pencils of Hokusai, Yosai, and a hundred lesser artists. They are probably no more apocryphal than many of the wearisome details through which the student of history must plod.

The title "Geschichte des Japanischen Volkes" adopted by the author is somewhat misplaced. The history is not that of the people but of their rulers, and it would have been well had the author given the section a better claim to the heading by interspersing the story of battle and murder by some account of the development of laws, literature, painting, the various industrial arts, and such important social ceremonies as those of the *Cha-no-yu*, which lose much of their significance when divorced from the general history of the empire.

The most valuable portion of the sketch to the foreign world is that relating to the pregnant events of the last

twenty years. In the narration of occurrences which have compelled the foreign powers, and especially Great Britain, to join issue with the Japanese Government Dr. Rein displays an absence of partisanship quite novel to those experienced in the discussion of Anglo-Japanese politics. His review of the present position and future prospects of the nation is thoughtfully cautious, and while drawing attention to the recent educational studies and the many wise acts of the present Government, shows a dark reverse to the picture in the financial difficulties now threatening serious obstruction to the path of improvement. The question of the opening of new ports or of the entire country to foreign enterprise and capital is also considered, and the writer points out the deadlock created on the one side by the great disadvantages which the Japanese foresee in admitting to competition an infinitely stronger commercial race, over whose actions they can have no judicial control, and on the other by the inexpediency, from the foreigners' point of view, of a surrender of the treaty rights while the laws and means of administration in Japan are in so unsatisfactory a condition as at the present time.

In an interesting chapter upon the Ethnography of the Japanese the author takes up the vexed problem of the origin of the now dominant race, who displaced the aboriginal Ainos. He believes, from considerations of speech, physiognomy, and traditions that they are a branch of the old Altaic family, which spread from its birthplace in all directions over the continent of Asia, some reaching Japan *via* Tsushima, Iki, and Oki, others settling at various parts of the mainland to form the Korean, Mandchurian, and other kindred people. In this view he is supported to some extent by the physiological identity with the Japanese of the yet pure descendants of the Korean potters brought over as trophies of Taiko's victorious arms at the end of the sixteenth century, and established in the province of Satsuma. Mr. Aston's researches into the comparative philology of the Japanese and Korean languages (*Trans. Royal Asiatic Society*, 1879) tend to a similar conclusion, but leave the question still open.

The analyses of literature, language, and religion are necessarily incomplete, but awaiting the further progress of the labours of the scholars now engaged in the study of these special branches, Dr. Rein's summary of the present knowledge will be of great service.

The author's views as to the character of the Japanese as a race are neither romantically favourable, like those of the great majority of travellers, nor unjustly contemptuous, like the convictions cherished by nearly all settlers. The national defects Dr. Rein considers to be a greed for novelty and a lack of stability and perseverance; but although this verdict would appear to be sanctioned by recent experience, the history of the country really points to nothing less than instability. A blind admiration for antiquity and a persevering if not energetic industry has characterised nearly the whole of their older manufactures and artistic productions, and the many centuries of persistence in the path opened by their forefathers were terminated only by a sudden change of circumstances, and an entirely forced and unsought relationship with the outer world. They are now learning an entirely new exercise of their powers, and some clumsiness at the

outset is inevitable, while the very impetuosity of their progression necessarily brings their faults more easily within the scope of a passing glance. They have now bought experience, and until the world sees how they can utilise their expensive purchase any judgment is premature. They have indeed two serious drawbacks, poverty of material resources, and a written language that isolates them from the European world, and imposes serious limitations upon the interchange of the higher order of ideas amongst themselves; but the present generation can scarcely be blamed for either evil. If there be a charge in the past and present to which they are fairly open it is defect of invention, for as their recent knowledge is taken from Europe, so in former times were they indebted to the Asiatic continent for literature, arts, religion, and laws, as well as for a thousand smaller traits of civilisation, some of which they have preserved longer or better than their teachers.

Whatever dispraise is laid upon the people, nearly all writers agree to credit them with remarkable cleanliness. Miss Bird, however, who has studied Japan under a new aspect, gives a different testimony as to the interior, and the few travellers who have caught a glimpse of the unbeaten tracks of the great cities might make strange revelations. As the better class European generally knows little or nothing of the secrets of his own metropolitan slums, it is conceivable that a foreigner living in Tokio may not be aware that it contains other habitations than those he passes in the public thoroughfares; but were curiosity or chance to lead him to thread some of the little, hardly noticeable, inlets which here and there break the line of the street dwellings he would be startled by the new world revealed to him—one where the hundreds of thousands of poor of the great city live, densely packed in filth and disease, in dilapidated dens with crumbling walls and roofs that would render needless the spell of Asmodeus to the Don Cleofas who cares to peer at the miseries only half concealed by the long lines of sheds, moated with foul stagnant drains, flanked by reeking accumulations of sewage and garbage, and cut off from ventilating breezes by the dwellings of the more fortunate but less numerous citizens. Had Dr. Rein extended his pilgrimage to the *Uradana* he would have written a new and curious chapter.

As regards bathing, it is certainly a common custom, but with the poorer classes it is far less frequent than travellers would lead us to believe. It is moreover not so much dictated by any unconquerable intolerance of dirt as by the combined attractions of warm water and neighbourly gossip. Whatever purification may be derived from the common use of a limited quantity of water by several dozens of people, it is doubtful whether we may not take as a set-off the odoriferous condition of the unwashed winter garments which often do unrelieved duty day and night for the whole season, and the very scant attention that the native feels impelled to bestow upon his hands and face in the intervals of his visits to the bathing-house. These remarks however do not imply that the working orders in Japan compare unfavourably in respect to physical purity with their European brethren.

The maps and illustrations are excellent in choice and execution. One error must however be indicated in the woodcut described as a "*Riu-kiu-Insulander*," which is

really an accurate portrait of the Korean envoy who visited Japan in 1877.

It is impossible to do justice to Dr. Rein's important book in the space at our command. Its construction is eminently scientific, and its thoroughness will excite the admiration of all who know the difficulty of obtaining, and especially of selecting, information upon many of the matters so exhaustively treated. The errors are few and seldom important, and will probably disappear in the next edition. One powerful recommendation is the absence of the *ego* from its pages; the author everywhere studiously keeps his own individuality concealed, and in the discussion of most points he is nearly always contented with such a statement and grouping of the principal facts as will leave the inference well within the grasp of the reader's mind. In conclusion, it is the best of the many publications upon the subject of Japan that have appeared in the last ten years, and, unlike most of the number, supplies a real want, and will be received gratefully by all who seek for solid, trustworthy information. We trust that the completion of the work will soon be issued.

OUR BOOK SHELF

Études géométriques et cinématiques. Note sur quelques Questions de Géométrie et de Cinématique, et Réponse aux Réclamations de M. l'Abbé Aoust. Par E. J. Habich. 80 pp. (Lima, 1880.)

M. L'ABBÉ Aoust, author of the "Analyse infinitésimale des Courbes planes," and our author put forward conflicting claims as to priority of discovery.

The polemics have fired off their powder in *Les Mondes* (tome iv., 1880, Aoust: tome I., 1879, Habich; see also the *Comptes rendus*, lxxv., 1877, and lxxxix., 1879), and the object of the present pamphlet is "de réduire à leur juste valeur les assertions" of the Abbé. The matters in dispute can be inferred from the three divisions of the present work:—

"1. Développoides—considérations historiques, étude des enveloppes des droites par la considération du centre instantané de rotation, développoides des divers ordres et développoides inverses.

"2. Coordonnées tangentielles-polaires.

"3. Mouvement géométrique d'une figure plane dans son plan—considérations générales, mouvement géométrique déterminé par deux systèmes d'enveloppées et d'enveloppes, mouvement d'une droite sur un plan."

We have, of course, but one side of the quarrel presented to us, but leaving polemics on one side there is a great deal of interesting matter put before us. Time will, no doubt, settle the question of priority.

A Synopsis of Elementary Results in Pure and Applied Mathematics. By G. S. Carr, B.A. Vol. i. part viii. (C. F. Hodgson and Son, 1880.)

WE recently noticed with approval the volume containing the first seven parts. This eighth part carries on the articles from 1400 to 1868, and is concerned with the differential calculus. It contains an abstract of the usual processes, and besides gives a succinct account of the theory of operations, and an analysis of matters which are treated of in the higher algebra, as Jacobians and quantics, and closes with maxima and minima, the geometrical applications being reserved for the parts on Co-ordinate Geometry.

These fifty-six pages are very correctly printed, at least we have not detected more than three or four trivial typographical errors.

This part maintains the handy character for reference of its forerunners.

The Practical Fisherman. By T. H. Keene. (London: The Bazaar Office.)

THIS book deals with the natural history, the legendary lore, and the capture of British freshwater fish, together with the art of tackle-making. The author has bestowed great care on his work, and seems to have studied every book written or published on the charming subject from Oppian to the present time. Mr. Keene is besides an enthusiastic fisherman, and has thus produced a treatise of great interest to the practical angler. We may add that this work is almost the only one on angling which treats of the natural as well as the traditional history of fishes.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

The Movements of Leaves

FRITZ MUELLER has sent me some additional observations on the movements of leaves, when exposed to a bright light. Such movements seem to be as well developed and as diversified under the bright sun of Brazil, as are the well-known sleep or nyctitropic movements of plants in all parts of the world. This result has interested me much, as I long doubted whether paraheliotropic movements were common enough to deserve to be separately designated. It is a remarkable fact that in certain species these movements closely resemble the sleep movements of allied forms. Thus the leaflets of one of the Brazilian Cassiae assume when exposed to sunshine nearly the same position as those of the not distantly allied *Hæmatoxylon* when asleep, as shown in Fig. 153 of "The Movements of Plants." Whereas the leaflets of this Cassia sleep by moving down and rotating on their axes, in the same peculiar manner as in so many other species of the genus. Again, with an unnamed species of *Phyllanthus*, the leaves move forwards at night, so that their midribs then stand nearly parallel to the horizontal branches from which they spring; but when they are exposed to bright sunshine they rise up vertically, and their upper surfaces come into contact, as they are opposite. Now this is the position which the leaves of another species, namely *Phyllanthus compressus*, assume when they go to sleep at night. Fritz Müller states that the paraheliotropic movements of the leaves of a *Mucuna*, a large twining Papilionaceous plant, are strange and inexplicable; the leaflets sleep by hanging vertically down, but under bright sunshine the petiole rises vertically up, and the terminal leaflet rotates by means of its pulvinus through an angle of 180°, and thus its upper surface stands on the same side with the lower surfaces of the lateral leaflets. Fritz Müller adds, "I do not understand the meaning of this rotation of the terminal leaflet, as even without such a movement it would be apparently equally well protected against the rays of the sun. The leaflets, also, on many of the leaves on the same plant assume various other strange positions." With one species of *Desmodium*, presently to be mentioned as sleeping in a remarkable manner, the leaflets rise up vertically when exposed to bright sunshine, and the upper surfaces of the lateral leaflets are thus brought into contact. The leaves of *Bauhinia grandiflora* go to sleep at an unusually early hour in the evening, and in the manner described at p. 373 of "The Movements of Plants," namely, by the two halves of the same leaf rising up and coming into close contact: now the leaves of *Bauhinia Brasiliensis* do not sleep, as far as Fritz Müller has seen, but they are very sensitive to a bright light, and when thus exposed the two halves rise up and stand at 45° or upwards above the horizon.

Fritz Müller has sent me some cases, in addition to those given in my former letter of March 3, of the leaves of closely-allied plants which assume a vertical position at night by widely different movements; and these cases are of interest as indicating that sleep-movements have been acquired for a special purpose. We have just seen that of two species of *Bauhinia* the leaves of one sleep conspicuously, while those of a second species appa-